AN UPPER CRETACEOUS VERTEBRATE ASSEMBLAGE FROM BIG BROOK, NEW JERSEY

By

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Introduction

Big Brook, a shallow stream just outside the town of Freehold, Monmouth County, New Jersey, has been a renowned locality for the recovery of Cretaceous fossil vertebrates since the turn of the century. It is very accessible and can be reached by taking Route 79 North out of Freehold for 5.3 miles, turning right onto Route 520 for one mile, and turning right onto Boundary Road for 1.5 miles. [See also Stop 4 of the road log in "Paleontology, biostratigraphy, and depositional environments of the Cretaceous-Tertiary transition in the New Jersey Coastal Plain," by Gallagher *et al.*, in this issue of *The Mosasaur.* —Ed.]

Students from the Southeast Delco School District's Academy Park and Sharon Hill High Schools, Sharon Hill, Pennsylvania, have visited this site on a regular basis since 1980 and have collected, identified, and turned in over 3,600 vertebrate specimens. This number represents less than 50 percent of the total number of fossils which were actually found. Invertebrates, broken specimens not identifiable to genera, and teeth kept by students for their personal collections were not included in this count.

All specimens were collected in trays made of 1/4-inch hardware cloth suspended in the bottoms of 20-inch-square wooden boxes made from 1/2-by-2-inch furring strips. Gravel from the streambed is shoveled into the trays, washed in the stream to remove silt and mud, and the remaining material examined for fossils. Water level ranges from ankle-deep to knee-deep; occasional deep holes are encountered, too.

Fossils can be found upstream from the Boundary Road Bridge for a distance of up to two miles, and downstream for an even greater distance. The collecting seems to be better the farther one moves upstream, probably due to the lesser number of competing collectors and better outcrop exposures.

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This collecting locality is an excellent source of fossils for both casual and serious collectors and has worked out very well as a field trip location.

Geology

In the vicinity of Boundary Road Bridge, Big Brook cuts through the Upper Campanian Marshalltown, Wenonah, and undifferentiated Mount Laurel-Navesink Formations. Downstream from the bridge is an outcrop of the Mount Laurel-Navesink sands which yields numerous invertebrates as well as vertebrates. This formation is a light gray, coarse clastic sand which contains some clay and is characterized by the presence of the index fossils *Belemnitella americana* and *Exogyra cancellata.*

The strata become increasingly older as one travels upstream, and the Mount Laurel-Navesink grades into the unconsolidated dark gray, silty, very fine sand of the Wenonah Formation. Owens *et al.* (1970) reported the Wenonah as being fairly unfossiliferous, but at Big Brook there is a localized 18-inch-thick "bone bed" which is exposed at and above water level about 1-1/2 miles from the bridge. *In situ* collecting has been done at this outcrop by the author and the material is currently under study by E. Hartstein and the author.

Further upstream, the Wenonah Formation grades into the massive, greenish-gray, fine silty sands of the Marshalltown Formation. The Marshalltown, locally abundant with vertebrates, is often difficult to distinguish from the underlying Wenonah.

All of the formations were deposited in shallow water and record a continuous rising and falling of sea level. The fossil vertebrates are typical of those which would have lived in this type of environment.

Paleontology

The vertebrates collected are fairly typical of those which would have lived in shallow waters. The groups Chondrichthyes, Osteichthyes, and Reptilia are represented.

Teeth from members of the Chondrichthyes, or "cartilage-fish," are the most abundant vertebrate fossils at Big Brook. They make up more than 90 percent of the total vertebrates collected there. The most common species are the two extinct crow sharks, *Squalicorax kaupi* and *S. pristodontus.* Due to the difficulty in distinguishing between the two species, they have been grouped under *Squalicorax* sp. in Table 1.

The varied-shaped teeth of the goblin shark, *Scaphanothynchus texanus,* are the second most common tooth found at Big Brook and are increasingly more abundant as one travels upstream.

The ancestral mackeral sharks *Plicatolamna* and *Cretolamna* are commonly found, as are teeth of the sand shark, *Odontaspis.*

Teeth and rostral spines from sawfish, rays, and skates are present but not in large numbers. Most of the specimens are broken or are in poor condition.

In addition to teeth, occasional shark vertebrae or coprolites are found in the stream.

Table 1. Fossil abundance.

	No. of Specimens	Percentage
Chondrichthyes		
Squalicorax sp.	1906	51.86
Scapanorhynchus texanus	654	17.79
Plicatolamna arcuata	311	8.46
Cretolamna appendiculata	246	6.69
Odontaspis sp.	228	6.20
Paranomotodon angustidens	48	1.31
Ischyrhiza mira	30	0.79
Brachyrhizodus wichitaensis	29	0.79
Ischyodus bifurcatus	9	0.25
Hybodus sp.	4	0.11
Coprolite	4	0.11
Dermal ossicles	3	0.08
Plicatolamna borodini	2	0.05
Pseudohypolophus sp.	1	0.02
Rhombodus levis	1	0.02
Shark vertebra	1	0.02
Osteichthyes		
Enchodus ferox (isolated teeth)	93	2.53
E. ferox (jaw fragments)	63	1.71
Anomoeodus phaseolus	15	0.41
Xiphactinus sp.	5	0.14
Stephanodus sp.	3	0.08
Teleost scale	1	0.02
Reptilia		
Mosasaur teeth (fragments)	18	0.49
Trionyx sp.	2	0.05
TOTALS..............................	3677	99.98

Table 2. Common names.

Squalicorax	extinct crow shark
Scaphanorhyncus	goblin shark
Plicatolamna	primitive makeral shark
Cretolamna	primitive makeral shark
Odontaspis	primitive makeral shark
Paranomotodon	primitive thresher shark
Hybodus	hybodont shark
Ischyrhiza	sawfish
Ischyodus	ratfish; rabbitfish
Brachyrhizodus	ray
Rhombodus	skate
Pseudohypolophus	skate
Enchodus	primitive pike
Stephanodus	ancestral mailcheeked fish
Xiphactinus	primitive tarpon
Anomoeodus	extinct pycnodontid fish
Trionyx	soft-shelled turtle
Mosasaurus	sea lizard

The Class Osteichthyes, or "bony-fish," is well represented by the fairly common isolated teeth and jaw sections of *Enchodus ferox.* Rarer finds are single teeth from the battery of the coral nibbler, *Anomoeodus*, and isolated lateral teeth from the giant tarpon-like *Xiphactinus.*

The Reptilia include partial plates from the soft-shelled turtle, *Trionyx*, and isolated broken teeth of the marine reptile, *Mosasaurus.*

Plesiosaur material has been found by a number of individual collectors, but none has been recovered by the school groups.

Discussion

The material collected at this site is what one would expect to find in an Upper Campanian shallow-water vertebrate assemblage. This is based on previous studies and collections made by the author in Delaware, Maryland, and Texas.

The material collected is slightly biased towards larger teeth due to the size of the holes in the collecting boxes. The smaller teeth fall through the screen and are lost in the stream or are not recognized in the trays by the collectors.

The variety of teeth increases as one moves upstream and reaches the Wenonah and Marshalltown outcrops. This may be due to the sorting action of the stream, the relative abundance of fossils in the outcrop, or the decline in species due to an environmental or evolutionary change.

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Mr. Eugene Hartstein provided photographs for the plates and acted as a chaperone for most of the field trips.

Special thanks are extended to the various students who braved the depths of Big Brook in search of ancient shark teeth. To them this paper is gratefully dedicated.

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PLATE I

1 *Squalicorax kaupi*; front or lingual view of a typical tooth
2 *S. kaupi*; rear or labial view of a typical tooth
3 *S.* cf. *pristodontus*; front or lingual view of a typical tooth
4 *S.* cf. *pristodontus*; rear or labial view of a typical tooth
5 *Cretolamna appendiculata*; rear or labial view of a typical tooth
6 *C. appendiculata*; rear or labial view of a typical tooth
7 *Paranomotodon angustidens*; rear or labial view of a front tooth
8 *P. angustidens*; rear or labial view of a side tooth
9 *Scapanorhynchus texanus*; front or lingual view of an anterior tooth
10 *S. texanus*; rear or labial view of an anterior tooth
11 *S. texanus*; rear or labial view of an upper lateral tooth
12 *S. texanus*; front or lingual view of a lower lateral tooth
13 *S. texanus*; front or lingual view of an upper lateral tooth
14 *S. texanus*; rear or labial view of a lower lateral tooth
15 *Plicatolmana arcuata*; front or lingual view of a typical tooth
16 *Hybodus* sp.; rear or labial view of a typical tooth
17 *Plicatolamna arcuata*; rear or labial view of a typical tooth
18 *P. borodini*; front or lingual view of a typical tooth
19 *P. borodini*; rear or labial view of a typical tooth

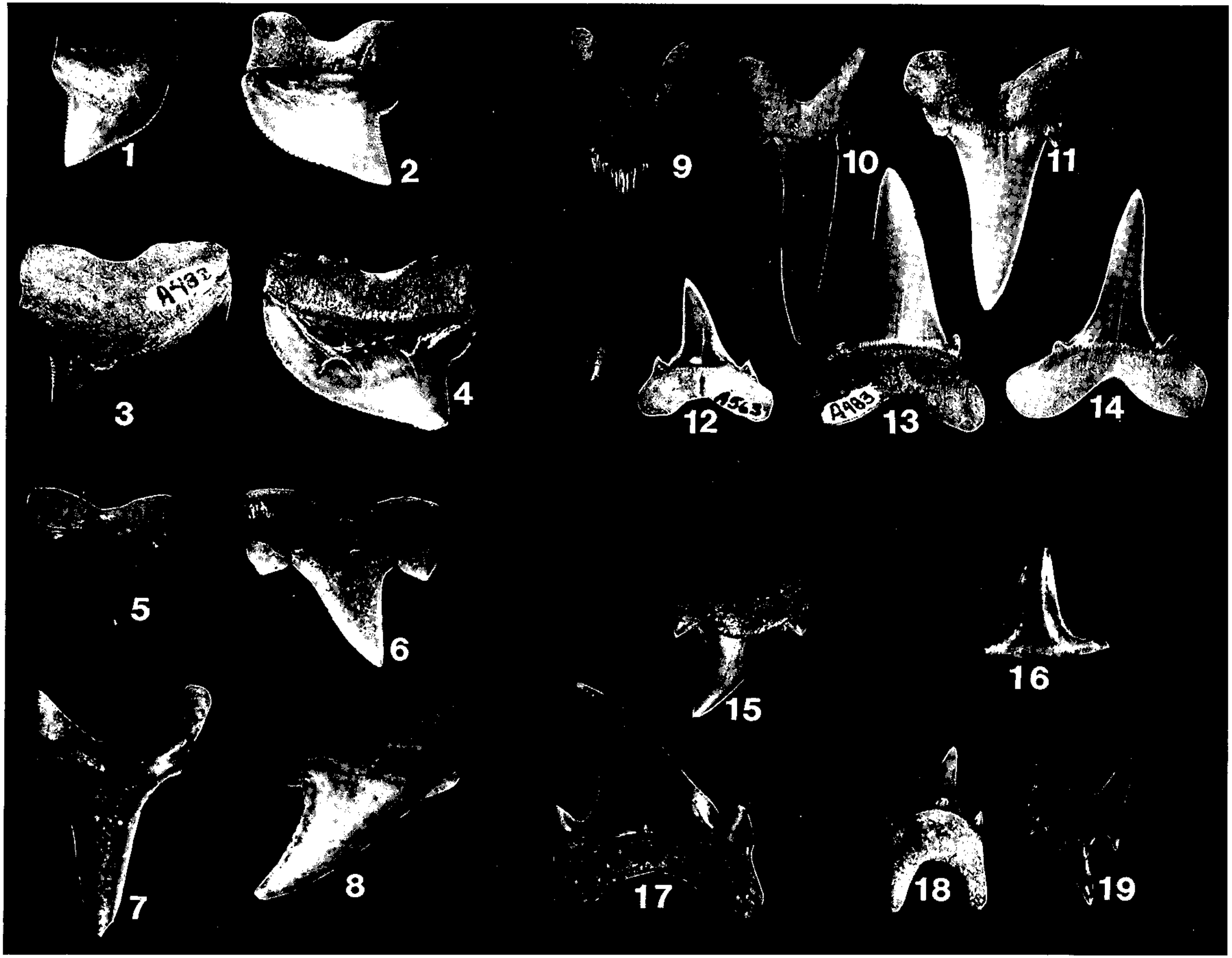
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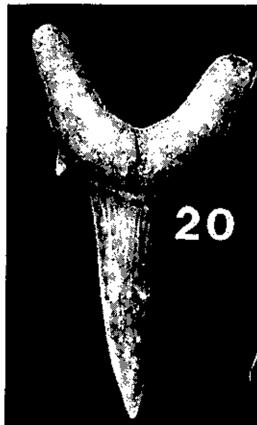
PLATE II

20 *Odontaspis* sp.; front or lingual view of a typical tooth
21 *Odontaspis* sp.; rear or labial view of a typical tooth
22 *Ischyrhiza mira*; rostral spine from a sawfish
23 *Brachyrhizodus wichitaensis*; top or occlusal view of a ray tooth
24 *B. wichitaensis*; bottom or basal view of a ray tooth
25 Shark vertebra; side or lateral view of a typical vertebra

26 The stream is shallow and the best fossils are found by traveling upstream from the bridge
27 Gravel from the streambed is shoveled into the trays and washed in the stream
28 Large rocks and organic material are removed from the trays
29 All material remaining in the trays is examined for fossils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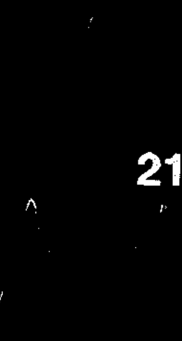
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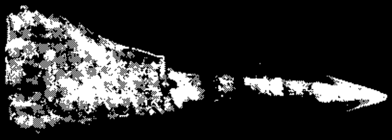
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